NORTH-HOLLAND

Guest Editor's Page

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This double issue is devoted to the presentation of articles on Fuzzy Control that were first presented and discussed during the third annual workshop on *Current Issues in Fuzzy Technologies* organized by the University of Trento in 1993. The focus of the workshop for that year centered on broad issues related to Fuzzy Control and in particular to the design, tuning, and applications of fuzzy controllers.

The workshop serves as a forum for scientists to report their work and their results, as well as an occasion to "sound off" their ideas and solutions with other fellow scientists. The articles in this special issue are derived from a subset of the several presentations at the workshop and the ensuing (sometimes lively) discussions.

The following selection of articles covers different aspects of the application of fuzzy logic in control, ranging from analysis and design to tuning.

The *analysis* concerns some mathematical issues that must be considered to guarantee that the resulting system will exhibit certain properties.

The *design* of the controller can be simplified by using terms that are naturally used in the context of a specific application, so that the area-specific experts themselves can participate directly in the design process, without the mediation and restrictions of another (mathematical) language. When the design of a controller is deemed too complex, (semi)automatic techniques are introduced to ease the task: rules can be interpolated from fewer base rules, neural networks can help defining the number and shape of the membership functions, and so on.

After the initial definition of a fuzzy controller, its performance is evaluated and a *tuning* phase is usually needed to reach satisfactory behavior. Once again, this process is hard to formalize in purely algorithmic terms and hence one looks for "intelligent" alternatives to trial and error testing to help the tuning process.

In his article, L. Koczy provides an overview of the current methods employed in the design of fuzzy controllers. Techniques to reduce the

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computational load required to evaluate the rules are presented and the properties of such interpolations are evaluated and discussed. Finally, the problems related to a very high number (hundreds or more) of state variables are examined and a hierarchical structure of rule bases similar to Sugheno's approach is proposed.

J. Kacprzyk and M. Fedrizzi address the opposite problem: how to interpolate "sparse" rules, i.e., when the experts provide only a limited number of observations—to generate a complete rule set.

R. Yager's article shows that OWA operators can provide the general framework for rule evaluation where the consequents are expressed linguistically.

In his article, V. Novak examines the problem of the "meaning" of linguistically expressed rules, so that a fuzzy controller can be both designed and tuned using words from the natural language.

Generation of a Fuzzy Controller and its tuning are issues that are addressed in the articles by S. Halagamuge, W. Pöchmüller, and M. Glesner who propose to generate the membership functions by means of a neural network and of F. Herrera, M. Lozano, and J. L. Verdegay who propose to use genetic algorithms for the tuning process.

Finally, G. Borgogna and G. Pasi present a fuzzy information retrieval system that is run-time tunable according to the user needs and expectations.